as the hydrolysis of cane sugar by acids, an action which has been studied so carefully and been found to be proportional to the number of hydrogen ions, it is not proved that the hydrolysis is due to the hydrogen ion independently of the anion, and it seems most improbable to the writers that such is the case. The monatomic ions differ from atoms only in the possession of an electric charge. Hence ion action can only differ from atomic action in consequence of this charge. The writers have been unable to find any evidence in physiology or pharmacology that an ion ever effects a functional change in consequence of this charge. Such a demonstration would be heartily welcomed. The expression ion action in the sense in which it is so often used in physiological literature seems unwarranted.

It must be added that the brilliant results which have been attained in the field of salt action are in no way affected by whatever explanation they may ultimately receive.

A. S. Loevenhart,
J. H. Kastle.

DEATH GULCH.

It is certain that nowhere within a like area can be found so many natural features of greatest interest as those to be seen in the Yellowstone National Park.

Not the least of these is Death Gulch, discovered in 1888 by Walter Harvey Weed, of the United States Geological Survey.

Mr. Weed's description of his discovery appears in Science, February 15, 1889, and contains information concerning geological features, comparisons with the Death Valley of Java and other matters of general interest.

At this time bodies of five bears, one elk, many small mammals in various stages of decomposition, and numerous insects were found. None of the animals showing signs of violence, Mr. Weed concluded death was caused by poisonous gas.

In 1897 Dr. T. A. Jaggar, Jr.,* visited the gulch, finding the carcasses of seven grizzlies and one cinnamon bear.

Tests made at various places along the bottom of the gulch failed to show sufficient gas to extinguish the flames of burning matches.

A year or two later Capt. H. M. Chittenden visited the gulch and found no animal remains nor any evidence of noxious gases.*

This experience caused him to express considerable doubt as to the authenticity of previous accounts.

As both Weed and Jaggar have indicated, the gulch is of such a nature, it is almost certain to be cleaned out periodically by freshets resulting from melting snow or heavy rains.

Quoting from the journal of the corporal in charge of the Soda Butte Station, the following extract needs no comment.

May 3, 1898.—Lt. Lindsley and Corpl. Herb left station for Cache (Creek). Followed trail to Death Gulch. Crossed Cache Creek at Death Gulch and patrolled two gulches to find the one in which supposed skeletons were to be found. Run into a bear track and in following it, came to Death Gulch. Corporal Herb went into it to the bottom and counted seven bear, brown silvertip and one grizzly. Part of gulch covered with snow. Signs of bear abundantly on both sides. The smell is that prevalent throughout the sulphur regions of the park. On being in the bottom of the gulch the sensation experienced was that of dizziness leaving a headache behind.

May 28, 1898.—Pvts. Root, McDonald and Edwards, mounted to Death Gulch. Counted carcasses of seven bear and one fox. Saw fresh signs of large bear on east side of gulch.

August 10, 1902.—Pvt. Wilson from station to Death Gulch, found carcass of bear having recently died, probably within twenty-four hours.

It has been my good fortune to visit Death Gulch, three different times. The first in 1900 when returning from Hoodoo Basin, our party camped near the mouth of Cache Creek and visited the gulch. We counted the carcasses of four large bears, and saw the remains of many other animals, represented mainly by bones with occasional tufts of hair. At this time the smell of sulphureted hydrogen was noticeable, and I determined then to learn, when possible, the composition of the gas of the gulch.

With this end in view, I went to the park in June of the past year, with apparatus for the analysis of gases.

* *The Popular Science Monthly*, February, 1889.

* 'The Yellowstone National Park,' fourth edition, p. 335.

Upon reaching Soda Butte Creek, however, I found the waters too high to permit safe fording with a wagon, and had to be content with a horseback ride to the gulch without my apparatus. The only fresh animal remains I then found were those of a small bear which I supposed was the bear Corporal Wilson, of Soda Butte Station, had discovered the preceding year. The smell of sulphureted hydrogen was very strong, and later I noticed the silver coins I had in my trousers pocket while in the gulch were much tarnished.

In August we were successful in getting the apparatus over to the gulch. The wind was blowing at a fair rate during all the time we were in the gulch, and occasional sharp showers of rain occurred.

Notwithstanding the extremely favorable conditions for the rapid diffusion of gases, the air near the bottom of the gulch showed the presence of more than ten per cent. of carbon dioxide, and strong traces of sulphureted hydrogen. A search for the outlets of the gas showed fissures on the *sides* of the gulch from which the gas literally poured.

One crevice in particular, an opening about fourteen inches long by four inches high, furnished so much gas we decided to analyze it, and found a little over one per cent. of sulphureted hydrogen, and more than fifty per cent. of carbon dioxide, and we have reason to believe the percentage of these gases was even higher than these figures, for there were several ways in which the air, constituting the remainder of the sample, may have entered the bottle. But these results show how, upon still days when gaseous diffusion is not very active, a sufficient percentage of gases to cause death might remain mixed with the air along the bottom of the gulch.

The question of sulphureted hydrogen poisoning has not been very carefully studied, and it is difficult to obtain any reliable data concerning it.

The following translation, however, gives some information on this point:*

Lehman states that when the proportion of sulphureted hydrogen in the atmosphere reaches one to three parts per thousand, animals die in it in ten minutes, with apoplectic symptoms and great difficulty in breathing.

An atmosphere containing one half part per thousand sulphureted hydrogen produces death with cramps and œdemic inflammation of the lungs.

It further produces rhinitis, conjunctivitis and laryngitis.

It may be characterized as a blood poison which decomposes the oxyhæmoglobin in the body to sulphmetahæmoglobin.

It may be concluded, then, that about one tenth per cent. in air is a sufficient amount to produce fatal results. This percentage would be reached by the dilution of the gas issuing from the fissure to ten volumes, which, considering the large quantity coming from this and similar fissures, would require a very large volume of fresh air. This dilution would reduce the carbon dioxide to five per cent., which would be considered generally a dangerous quantity.

Another interesting point in connection with the question of the poisonous effects of sulphureted hydrogen gas is that concerning its effect when associated with large amounts of carbon dioxide.

Would it not, for several reasons, be more dangerous, when associated with five per cent. of carbon dioxide? This phase of the question deserves careful investigation.

At the time of my last visit we found the remains of one small bear, the one I had noted in June, another bear, elk hides, three birds, including a mountain blue jay and a great horned owl, numerous old skeletons not identified, beetles, moths, butterflies, flies and maggots.

It is interesting to note, in respect to the dead maggots, the intermittent action of the gas. After the death of the bear on which they were found the atmosphere permitted the presence of flies which laid their eggs on the carcass. Maggots developed, lived for a time, until the gas became sufficiently strong to kill them.

Flies were flying about the gulch while we were carrying on our work. Some of these we caught and held in the escaping gas from the crevices. In each case death occurred on six seconds' exposure to the gas.

* 'Toxikologie für Thierärtze,' Eugene Fröhner, 2d ed., pp. 146, 147.

The slope from the bottom of Death Gulch from the mouth upward is very great, affording a hard climb for any who may attempt to pass up it. Occasionally, shelves are encountered adding to the difficulty of reaching the place where the animals are found. It is above one of these shelves or steps where all of the carcasses were lying, and the floor of the gulch at this place is comparatively level for a distance of twenty feet or more. At the upper end of this space and about four feet up the side is the fissure described. You may see this offers a fine opportunity for the accumulation of gas.

Thinking of the preservative effects of the gas, I believed at first the bear discovered by 'Pvt. Wilson' was the one I found the following June but later learned that the former was a large bear from which the claws had been taken by the soldiers, while the latter was a small bear still retaining its claws.

Water flowing in the upper part of the gulch has a distinct acid reaction. One determination showed the acidity calculated to sulphuric acid to be equal to one third of a gram to the liter. This acidity disappears before the lower part of the gulch is reached, a sample half way down from the top giving a neutral reaction.

The production of gas is probably connected with this neutralization of the acid water. The action of the acid on carbonates and sulphides liberates the gases.

The symptoms experienced by members of our party while in the gulch were not those of asphyxiation, the usual result of the action of carbon dioxide, but while no two were affected exactly alike, dizziness was noted in each case. In addition to dizziness one had nausea, another headache and the third was dizzy but noticed no other effect.

Taken altogether, the phenomena of this region are most interesting and deserve further study. In taking samples of the gas it was necessary to watch the flow of acidulated water containing cadmium sulphate, in which the sulphureted hydrogen was collected, to see that none of the precipitated cadmium sulphide was siphoned off.

Bending over watching this intently I was almost overcome by the gas, and but for the assistance of my friends in getting to fresh air I should have remained with 'Wahb' and his brethren at the bottom of Death Gulch.

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A LOACH FROM NANAIMO.

Through the kindness of Mr. Jaeger, of Brannan St., San Francisco, Stanford University has received a live specimen of a very mysterious fish. It is a loach, an eel-shaped fish with the head of a sucker and the beards of a cat-fish, a group of fishes abundant in the Old World in the brooks from Ireland to Japan, but never before found in America.

The loaches are very hardy, as much so as a salamander, and they sometimes come out into the wet grass in search of insects.

This loach was brought to San Francisco in a coaling ship from Nanaimo. He was said to have been found in a puddle in the coal-bank. He was put into a tumbler of water at San Francisco, and then revived. When I found him he was still in the glass of water and lively enough, the bottom of the glass being covered with coal dust.

His origin is a puzzle. Some patriotic Englishman might have brought a loach to Nanaimo. Some Chinaman may have carried about a live loach as good medicine. Some Japanese may have had him in his little tray-garden. It is not easy to conceive that this family should be native to America and that we should have overlooked it so long, while describing so many Asiatic and European species.

This loach has six barbels, short dorsal, a rounded caudal. It can not, therefore, belong to any one of the three European genera. Its place is in the genus *Orthrias,* lately framed by the writer for a species from northern Japan. But the new loach is not this species, nor does any one of the few Chinese species of *Orthrias,* of which I find accounts, resemble it very much.

This is clear. The loach from Nanaimo belongs to a new or rare species. It is either native to Vancouver Island or else it has been brought over alive from China. Meanwhile